

HOLLOW PANEL

BACKGROUND OF THE INVENTION

The present invention relates to a hollow
5 panel, and more particularly to a hollow panel which
is suitably used as a construction material such as
a wall material, a floor material, and a ceiling
material.

10 Conventionally, hollow panels having hollow
portions are employed as various kinds of panels for
construction. In such a hollow panel, it is
possible to realize heat insulation and weight
reduction. In a known hollow panel, two corrugated
15 plates in which end faces have a corrugated shape
are sandwiched between two flat plates constituting
surfaces to form one panel, and hollow portions
corresponding to the corrugated shape are laterally
extended (for example, see JP-A-7-214712). The
20 hollow panel disclosed in JP-A-7-214712 has a
configuration in which the two corrugated plates
are stacked back to back so that projections of the
plates abutted against each other are sandwiched
between the flat plates. In a completed state of
25 the panel, therefore, hollow portions of different

sectional areas are internally enclosed, so that a lack of sound insulation due to the coincidence effect which may be caused at a specific frequency can be improved.

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Since the hollow panel disclosed in JP-A-7-214712 is configured so that the sectional areas of the hollow portions are differentiated by using the two corrugated plates, a disadvantage
10 that the whole thickness of the hollow panel is increased, and other disadvantages that the cost burden due to the increased number of components is inevitably imposed, and that the corrugated plates must be bonded together to increase the number of
15 assembly steps are caused.

SUMMARY OF THE INVENTION

The invention has been conducted in view of the disadvantages. It is an object of the invention to
20 provide a hollow panel which can effectively exhibit the sound insulation performance while suppressing the panel thickness, and in which the number of components can be reduced, so that labor in the work of forming the panel can be reduced and
25 the production cost can be reduced.

In order to solve the aforesaid object, the invention is characterized by having the following arrangement.

5 Aspect 1. A hollow panel comprising:

first hollow portions arranged in a substantially same plane and having a first

sectional areas; and

10 second hollow portions arranged in the substantially same plane and having a second sectional areas different from the first sectional areas.

Aspect 2. The hollow panel according to the aspect 15 1, wherein the first hollow portion and the second hollow portion are alternatively arranged in the substantially same plane.

Aspect 3. The hollow panel according to the aspect 20 1, wherein a solid portion forming member is inserted into a specific one of the first and second hollow portions, the solid portion forming member having a section shape which substantially corresponds to a section shape of the specific 25 hollow portion.

Aspect 4. The hollow panel according to the aspect 1, wherein a sectional shape of the first and second hollow portions is a trapezoidal.

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Aspect 5. A hollow panel comprising:

first hollow portions arranged in a substantially same plane and having a first width; and

10 second hollow portions arranged in the substantially same plane and having a second width different from the first width.

Aspect 6. The hollow panel according to the aspect 15 5, wherein the first width is defined between a pair of partition walls defining the first hollow portion, and the second width is defined between a pair of partition walls defining the second hollow portion.

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Aspect 7. The hollow panel according to the aspect 5, wherein the first and second hollow portions are alternatively arranged in the substantially same plane.

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Aspect 8. The hollow panel according to the aspect
5, wherein a solid portion forming member is
inserted into a specific one of the first and second
hollow portions, the solid portion forming member
5 having a section shape which substantially
corresponds to a section shape of the specific
hollow portion.

Aspect 9. The hollow panel according to the aspect
10 5, wherein a sectional shape of the first and second
hollow portions is a trapezoidal.

Aspect 10. A hollow panel comprising:
first and second partition walls defining a
15 plurality of hollow portions arranged in a
substantially same plane, wherein a thickness of
the first partition walls is different from that of
the second partition walls.

20 Aspect 11. The hollow panel according to the
aspect 10, wherein the first and second partition
walls are alternatively arranged.

Aspect 12. The hollow panel according to the
25 aspect 10, wherein a solid portion forming member

is inserted into a specific one of the hollow portions, the solid portion forming member having a section shape which substantially corresponds to a section shape of the specific hollow portion.

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Aspect 13. A hollow panel comprising;

a plurality of hollow portions arranged in a substantially same plane; and

10 a solid portion disposed to extend over at least one of the plurality of hollow portions.

Aspect 14. The hollow panel according to the aspect 13, wherein a solid portion forming member is inserted into a specific one of the hollow
15 portions, the solid portion forming member having a section shape which substantially corresponds to a section shape of the specific hollow portion.

In the invention, a configuration may be
20 employed in which a solid portion forming member is inserted into a specific one(s) of the plural hollow portions, the solid portion forming member having a sectional area which generally corresponds to a sectional area of the specific hollow portion(s).
25 According to the configuration, the solid portion

forming member is placed in an arbitrary one(s) of the hollow portions, whereby the surface density can be partially differentiated. Therefore, the invention can be easily applied even to an existing
5 hollow panel so as to suppress a lack of sound insulation.

...The hollow panel of the invention can be formed by using any of various materials, and preferably
10 formed by using wood elements. Examples of wood elements are wood flakes, wood fibers, wood chips, and wood particles. The wood elements may be shaped into a panel-like shape by die molding. As a binder which is useful in the molding, any one of a foamable
15 binder resin, a nonfoamable binder resin, and a mixture of these binders may be employed.

The hollow panel can be produced by die molding in the following manner. A fixed amount of wood
20 elements are sprayed into dies, and cores corresponding to the shapes of the hollow portions are then laterally arranged in a substantially same plane. A further fixed amount of wood elements are sprayed onto the arrangement. Under this state, a
25 hot pressing process is performed. The dies are

opened, and the cores are then pulled out, whereby
a panel in which hollow portions are integrally
formed can be shaped. The hollow panel may be
obtained by another shaping method in the following
5 manner. Two front members having a thin plate-like
shape, and a single hollow portion forming member
which is similar in shape to a galvanized steel
sheet, or in which the end faces have a corrugated
shape are separately formed. The front members are
10 bonded together by an adequate adhesive agent so as
to sandwich the hollow portion forming member.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic perspective partial view
15 of a hollow panel of a first embodiment.

Fig. 2 is a partial end view of the hollow
panel.

Fig. 3 is a partial end view of a hollow panel
which is a modification of the first embodiment.

20 Fig. 4 is a partial end view of a hollow panel
of a second embodiment.

Fig. 5 is a partial end view of a hollow panel
of a third embodiment.

Fig. 6 is a schematic plan view of the hollow
25 panel of the third embodiment.

Fig. 7 is a schematic plan view of a hollow panel of a fourth embodiment.

Fig. 8 is a schematic plan view of a hollow panel which is a modification of the fourth
5 embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Hereinafter, embodiments of the invention will
be described with reference to the accompanying
10 drawings.

First embodiment

Fig. 1 is a schematic perspective view of a hollow panel according to a first embodiment, and
15 Fig. 2 is an end view of a part of the hollow panel. Referring to the figures, a hollow panel 10 that can be used as a construction material such as a wall panel, a floor panel, and a ceiling panel comprises a pair of flat outer sides 11 which are
20 substantially parallel to each other, and plural hollow portions 12 which are positioned between the outer sides 11 so as to be arranged in a substantially same plane.

25 Each of the hollow portions 12 has a shape which

linearly extends in a direction perpendicular to the plane of the sheet of Fig. 2. The hollow portions 12 are formed so that partition walls 13 which are arranged at predetermined intervals in the lateral
5 directions in the figure are inclined by an approximately same angle and to alternately different directions. As a result, each of the hollow portions 12 shows an approximately trapezoidal section shape. In the embodiment,
10 first hollow portions 12A having a smaller lateral width $W1$, and second hollow portions having a lateral width $W2$ which is larger than the lateral width $W1$ are formed so as to be alternately positioned along the lateral direction in Fig. 2,
15 so that the adjacent hollow portions 12A and 12B are disposed to be alternately different or nonuniform in sectional area. In the figure, the lateral widths $W1$ and $W2$ of the first and second hollow portions 12A and 12B are indicated as those at the
20 respective middle positions in the panel thickness direction because of the following reason. Since the partition walls 13 are inclined, the thicknesses are shown with reference to the respective middle positions for the sake of
25 convenience. Alternatively, the partition walls 13

may not be inclined, and may be modified so as to have a sinusoidal waveform, or an approximately pulse-like waveform so that the partition walls 13 are perpendicular to the outer sides in the panel thickness direction. As shown in Fig. 3, the hollow panel 10 may further comprise third hollow portions 12C which have a more larger width.

In the hollow panel 10, the lateral ends 10A in Fig. 1 have a closed structure in which the hollow portions 12 are not formed. According to the configuration, the rigidity is provided so that lateral end portions of the outer sides 11 are prevented from being bent in a direction perpendicular to the panel plane, whereby the shape retention property can be maintained.

According to the thus configured first embodiment, when the whole of the single hollow panel 10 is considered, the first and second hollow portions 12A and 12B are formed so as to have different sectional areas, and hence the relationships are attained in which the surface densities of areas substantially corresponding to the hollow portions 12A and 12B are different.

Therefore, a structure where the resonance frequency of the panel due to the sectional areas or sizes of the hollow portions is not uniform in the panel plane but dispersed is formed, and a lack
5 of sound insulation caused by resonance at a specific frequency can be effectively suppressed.

Next, other embodiments of the invention will be described. In the following description,
10 components which are identical with or equivalent to those of the first embodiment are denoted by the same reference numerals, and their description is omitted or simplified.

15 Second Embodiment

Fig. 4 shows a second embodiment of the invention. The embodiment is characterized in that, although the hollow portions 12 have the same sectional area, different thicknesses T1 and T2 of
20 the partition walls 13 between the hollow portions 12 alternately appear. The thicknesses are set so as to have a relationship of $T1 > T2$.

In the second embodiment also, the area of the
25 thickness T1 is higher in surface density than that

of the thickness T2, or higher in rigidity.

Therefore, the embodiment has a structure where the panel resonance frequency is not uniform in the plane of the hollow panel 10, and can exert the same
5 sound insulation effect as that of the first embodiment.

Third Embodiment

Figs. 5 and 6 show a third embodiment of the
10 invention. The embodiment is characterized in that a solid portion 15 is formed in a specific region where a hollow portion is to be originally formed. As shown in Fig. 6, the solid portion 15 may be formed linearly in a region corresponding to a single
15 hollow portion, or alternatively formed so as to extend over plural hollow portions 12. In the illustrated example, the solid portion 15 linearly extends. However, the manner of the extension is not limited to a linear one. It is possible to say
20 that the embodiment is realized by extremely increasing the thicknesses of specific ones of the partition walls 13.

Also the embodiment can exert the same effect
25 as that of the afore-described embodiments.

Fourth Embodiment

Fig. 7 shows a fourth embodiment of the invention. In the embodiment, a rod-like member 16
5 serving as a solid portion forming member is inserted into one of the hollow portions 12. The rod-like member has a section shape which generally corresponds to a section shape of the hollow portion. Therefore, the surface density is
10 partially differentiated, so that the above-mentioned sound insulation effect is attained. This configuration can be easily applied to a previously shaped hollow panel, so that the invention can be applied to an existing hollow
15 panel. When the insertion position of the rod-like member 16 is changed, it is possible to arbitrary determine the region of a different surface density.

20 As shown in Fig. 8, the rod-like member 16 may be placed in a direction intersecting with, for example, perpendicular to the direction along which the hollow portions 12 extend.

25 As described above, although the best

configuration, method, and the like for embodying the invention have been disclosed in the above description, the invention is not limited to them.

Namely, although the invention has been
5 illustrated and described with respect to specific embodiments, those skilled in the art can variously modify as required the above-described embodiments with respect the shape, the position, the arrangement, or the like without departing from the
10 technical concept and object of the invention. For example, the embodiments and modifications can be arbitrarily combined with each other. The number of the rod-like member 16 may be adequately increased or decreased as required. Various kinds
15 of the rod-like members 16 of different masses may be used to enable the distribution of the surface density to be finely differentiated.

As described above, according to the
20 invention, it is possible to provide a hollow panel that exerts an excellent effect in which the resonance frequency of the panel is not uniform in the panel plane but dispersed and hence a lack of sound insulation due to resonance can be
25 suppressed, and which cannot be exerted in the

conventional art. Since the hollow portions are arranged in a substantially same plane, the thickness of the hollow panel can be reduced.

- 5 In the case where the configuration in which a rod-like member is inserted into a hollow portion is employed, a portion where the surface density is partially differentiated can be arbitrarily determined to be placed, and therefore the
- 10 invention can be easily applied to suppress a lack of sound insulation.